e-Highway 2050

Main results

Gérald Sanchis (RTE) – Coordinator of the project
Introduction of e-Highway2050

Background

The Energy Roadmap 2050 is the basis for developing a long-term European framework.

General requirement of the project

“Planning for European Electricity Highways to ensure the reliable delivery of renewable electricity and Pan-European market integration”
A consortium of 28+8 partners

TSOs
- 50hertz
- amprion
- APG
- ČEPS
- elia group
- ENERGINET.DK
- ENERGNET.EE
- entsoe
- ADME
c
- PSE
- RED ELECTRICA DE ESPAÑA
- REN
- RTE
- Svenska Kraftnät
- swissgrid
- Terna

Industry
- eurelectric
- Europacable
- EWEA
- T&D Europe

Research institutes
- Brunel University London
- CSIC Comillas
- ECN
- Ensiel
- ENS
- KU Leuven
- RSE
- SINTEF
- TECNICO LIsboa

Experts
- Collingwood Environmental Planning
- dena
- E3G
- PÖYRY
- TECHNOFI

40 month project, from September 2012 to December 2015
How the issue has been processed?

Stakes by 2050?
- Identification of the electricity demand/generation by 2050.
- State of the electricity system, with the ‘present’ transmission grid.
- Highlighting the need for solutions in order to solve the congestion/spillage/energy not supplied.

Which additional transmission grid by 2050?
- Which transmission requirements in order to solve the constraints?
- Which technologies should be available by 2050?
- Which cost and benefit of the new grid architectures?
- Are the 2050 grid architectures operable?

How to develop the transmission grid from now up to 2050?
- Which intermediate architectures in order to reach the 2050 grid architectures?
- Which governance for a pan-European transmission grid?
The whole process

1. Grid model
2. Scenario definition
3. Grid development
4. Modular plan & BCA

Technology
Operation
Governance
The main results
Grid development

1. Grid model
2. Scenario definition
3. Grid development
4. Modular plan & BCA

Technology
Operation
Governance
Results: scenario 100% RES

100% RES

Transmission requirements (GW)
- 2050 reinforcements
- Starting grid
Results: scenario 100% RES

- 2030 grid
- Reinforcements (GW)

+X : Compared to 2012 (GW/%)

- Hydro
- Wind
- Solar
- Biomass
- Fossil
- Nuclear
- Average load
Results: scenario 100% RES

- 51 TWh of ENS avoided/year
- 465 TWh of spillage avoided/year
- 39 b€ of annual savings in operating costs

Total investment cost: 245-345 b€
The 2050 grid architectures

- An invariant set of new lines and reinforcements has been identified.
Modular plan

1. Grid model
2. Scenario definition
3. Grid development
4. Modular plan & BCA

Technology
Operation
Governance
From 2030 towards 2050

2030

1 GW  2.5 GW
5 GW  10 GW
15 GW  20 GW

Starting grid
Projects by 2030

2040

2050

100% RES
Transmission requirements (GW)
2050 reinforcements
Starting grid

Big & market
Transmission requirements (GW)
2050 reinforcements
Starting grid

Large-scale RES
Transmission requirements (GW)
2050 reinforcements
Starting grid

Fossil & nuclear
Transmission requirements (GW)
2050 reinforcements
Starting grid

Small & local
Transmission requirements (GW)
2050 reinforcements
Starting grid
Other key challenges

1 Grid model
2 Scenario definition
3 Grid development
4 Modular plan & BCA

Technology
Operation
Governance
Key challenges highlighted

• **Technology:**
  ➢ Needs for the improvement of the present technology on the transmission capacities, and the use (e.g. submarine in depth, DC technology).
  ➢ Needs for shared cost and performance technology data in open access.

• **Economy:**
  ➢ Need for a pan-European shared methodology for the technical-economic analysis of new network investments in the very long term.

• **Governance:**
  ➢ Need for the improvement of the regulatory framework in order to realize the grid architectures proposed.

• **Operation:**
  ➢ The high penetration of RES and HVDC in the power system should be further investigated.
In conclusion
Main messages (1/2)

• The project has defined, and applied a new methodology for the development of the transmission grid, able to:
  ➢ address long term horizons,
  ➢ cover the whole Europe,
  ➢ cope with the European low carbon objectives, translated at national, and local levels, while building global grid architectures.

• The project highlights transmission needs in order to reach the low carbon emission target in Europe:
  ➢ in consistency, and in continuity with the TYNDP,
  ➢ an invariant set of new lines and reinforcements appear useful and profitable, whatever the scenario studied.
  ➢ no needs for a new separate ‘layer’ within this existing grid.
The project not only provides **results** but also **methodologies** that can be re-used in future studies.

A Work Package of the project was even fully dedicated to develop **advanced methodologies** based on **optimization**.

More **research** and **industrialization** could make these methodologies available for TSOs in the coming years.
Thank you for your attention!

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